WE CLAIM:

1. A gas turbine engine fuel injection and combustor system, comprising:

an outer casing extending from an upstream end to a downstream end, an internal space of the downstream end defining a combustion chamber;

an annular dome connected to an internal upstream end of the outer casing;

a radial flow air swirler mounted to an internal surface of the annular dome and to an external surface of a fuel injector body, said swirler providing swirled air to the combustion chamber;

a fuel injector body mounted to an internal surface of the radial flow air swirler, said fuel injector body comprising a plurality of axially oriented air swirlers, an axially located pilot circuit fuel nozzle, and a plurality of radially oriented main circuit fuel nozzles;

whereby during low power gas turbine engine operation, pilot circuit fuel is mixed with axial swirler produced air flow, and is thereby caused to rotate in a vortex around a longitudinal axis of the combustion chamber and upon ignition produces a stable high temperature emission free flame;

whereby during intermediate and high power gas turbine engine operation, pilot circuit and main circuit fuel is mixed with radial and axial swirler produced air flow, and is thereby caused to rotate in a double vortex around the longitudinal axis of said combustion chamber, and upon ignition produces a stable, fuel lean, low temperature, low pollutant emission flame.

2. The gas turbine engine fuel injection and combustor system of claim 1, whereby a single fuel injector body incorporates both the pilot circuit and the main circuit fuel injection systems.

3. The gas turbine engine fuel injection and combustor system of claim 1, whereby the fuel injector body for the pilot and main circuit fuel injection systems is cylindrical.

4. The gas turbine engine fuel injection and combustor system of claim 1, whereby pilot circuit fuel and main circuit fuel are injected in the combustion chamber at essentially the same axial and radial locations.

5. The gas turbine engine fuel injection and combustor system of claim 1, whereby a pilot circuit fuel nozzle encircled by a plurality of axial air swirlers discharges fuel into a combustor creating a rotating vortex of vaporized fuel and air.

6. The gas turbine engine fuel injection and combustor system of claim 1, whereby main circuit fuel nozzles discharge fuel at a compound angle into a radial swirler passage creating a rotating vortex of vaporized fuel and air within the combustion chamber.

7. The gas turbine engine fuel injection and combustor system of claim 1, whereby the combined geometry of the pilot circuit and main circuit fuel injection systems provides short fuel-air residence times prior to entering the combustion chamber.

8. The gas turbine engine fuel injection and combustor system of claim 1, whereby at least four radially oriented main circuit fuel nozzles are employed.

9. The gas turbine engine fuel injection and combustor system of claim 1, whereby said fuel injection system is usable for both can type and annular type combustors.

10. The gas turbine engine fuel injection and combustor system of claim 1, whereby aerospace type fuels can be utilized can be utilized as the combustion medium.

11. The gas turbine engine fuel injection and combustor system of claim 1, whereby a variety of non-aerospace type fuels can be utilized as the combustion medium.

12. A method of producing a low emission gas at low and high power in a gas turbine engine combustor, comprising the steps of:

injecting pilot circuit fuel spray through a axially disposed nozzle into a combustor chamber;

swirling a first portion of air axially and flowing said swirled air into said combustor chamber to form a swirling mixture of pilot circuit fuel and air for low, intermediate, and high power operations;

swirling a second portion of air radially and flowing said swirled air into an air swirler passageway;

injecting main circuit fuel spray through radially disposed nozzles into said air swirler passageway and thereafter into said combustion chamber to form a swirling mixture of main circuit fuel and air for intermediate and high power operations;

expanding and igniting said swirling mixture of pilot circuit fuel and air to form said low emission gas for low and high power operations; and

expanding and igniting said swirling mixture of main circuit fuel and air to form said low emission gas for intermediate and high power operations.

13. The method of claim 12, wherein the step of expanding pilot circuit fuel and air forms a fuel rich, high flame temperature, zone in the combustion chamber.

14. The method of claim 12, wherein the step of expanding main circuit fuel and air forms a fuel lean, low flame temperature, zone in the combustion chamber.